Today's plan:

Reminder: Marking

Projects!

Announcements: status report

Final presentations and reports

Sensors

Motor drivers

Powering your project

Reminder - Marking:

To pass the course you have to:

1. Submit all three reports and check all the required parts (show them working to the TAs or instructor)

2. Present the final project and submit the final report.

If any of these elements above are missing, your grade will be lower of 45% or total of the points.

Marking:

A Lecture test 20%

Activities 5%

Programs and lab reports in first 6 weeks 20%

Project proposal 3%

Status report 2%

Project quality and functionality 20%

Presentation 10%

Final report 20%

Late report submissions - 10% of the grade will be subtracted per day down to 50%. We wave it for good reasons

Project is yours!

Find the info you need on line, use AI, discuss with colleagues but do not expect TA, a friend or me to do it for you!

We can help with errors in the code but can not provide example codes or “how to” instructions.

3d Printing is available for reasonable small items in the next room with the help of Bernhard our make room instructor, but you have to prepare the file.

Announcements: Status Report

I would like a short written status report from everyone turned in at start of the lab during the week of March 23th.

The report should discuss your progress so far: what has been accomplished, what remains to be done. If you have encountered problems, discuss them, and your plans to move forward. If you need help to make progress, please mention it.

These reports need not be long, just a few sentences or points are fine.

Announcements: Final Reports and presentations

- At the end of the course you'll present your project in two ways:

1) Oral presentation in class. These will happen on Tuesday April 7, Wednesday April 8 and Thursday April 9. These are reasonably informal. We will all look at the presentation, with slides if any, and the working project.

2) Formal written report, due April 13, 10PM.

Unfortunately no extensions!

Lecture test

Connections 2 points (1 if 1 missing). There were 6 connections in my model.

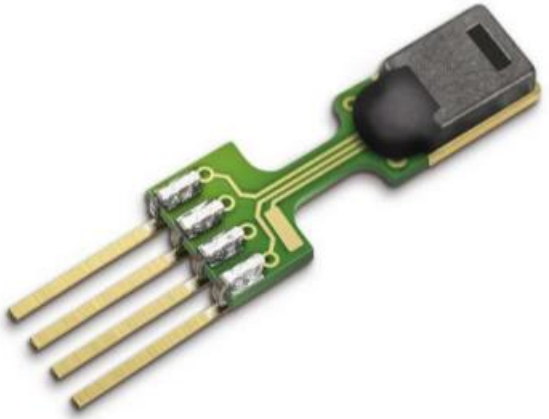
If the program is almost correct 2 points will be subtracted for any command which is missing or has to be changed to have it working.

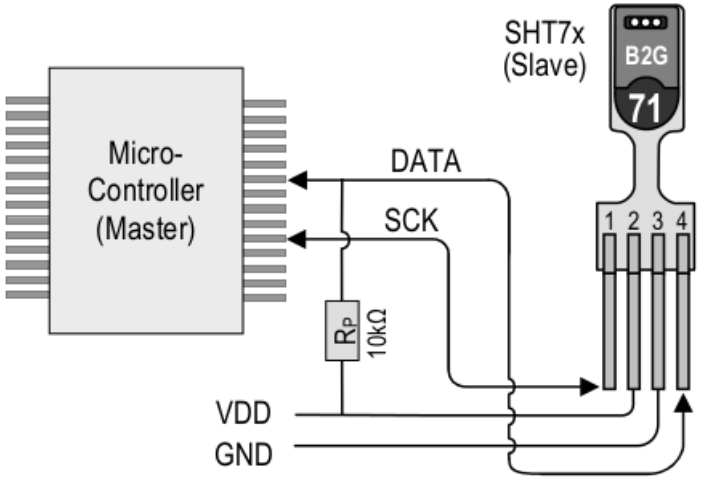
Available sensors:

- Optical sensors
- Temperature
- Humidity
- Magnetic field
- Pressure
- Distance
- Position and bend
- Accelerometer
- Gyroscope
- Alcohol
- GPS
- Infrared
- Infrared camera sensor
- Heart beat and blood oxygenetion

SHT75 Temperature and Humidity Sensor

- Fully Calibrated
- Digital output
- Low power consumption
- Excellent long term stability
- two-wire serial interface.
- Accuracy +/- 0.5C



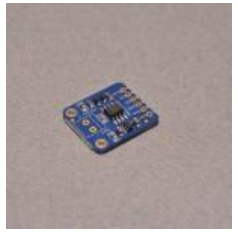


DS18B20 Temperature only

-Inexpensive,
- somewhat complicated interface
- high resolution 0.0625 degrees
- accuracy (+/- 0.5C)
- easy to multiplex many sensors

Also:

- Thermocouples
- Thermistors
- IR no contact sensor

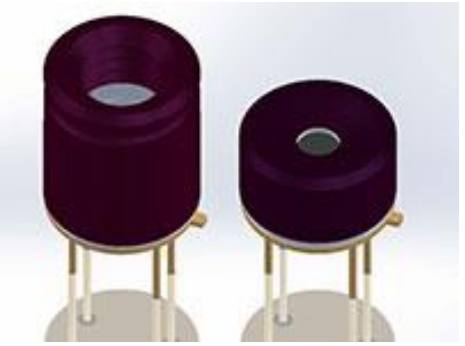


MLX90614:

Infrared camera sensor

MLX90640 FIR Sensor

- Small size, low cost 32 pixel x 24 pixel IR array
- Easy to integrate
- Industry-standard 4 lead TO39 package
- Factory calibrated
- I^2C compatible digital interface
- Programmable frame rate 0.5 Hz to 32 Hz
- 3 V supply voltage
- 2 FOV options: 55° x 35° and 110° x 75°



Distance Sensors:

- Optical:

short range QRD1114,
medium range GP2D12

- Ultrasonic

Magnetic Field Sensors:

- Hall effect

on-off vs field measurement

- magneto-resistive
- magneto-inductive
- Compass modules

eg: Devantech CMPS03 compass module

Position Sensor:

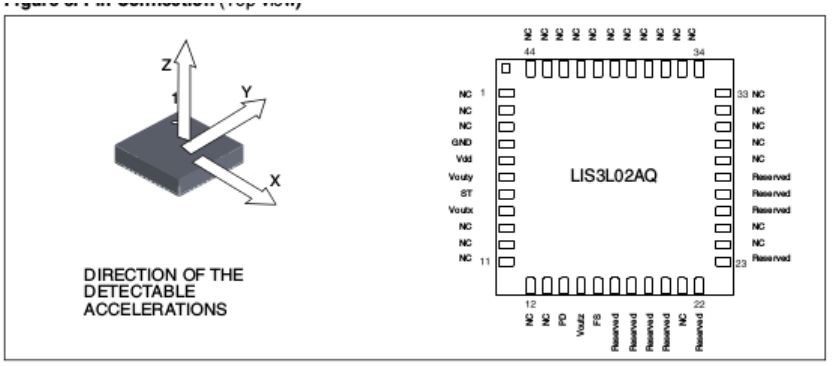
- Potentiometers (3/4 turn, 10 turn)
- Rotation sensor (unlimited turns)
- Linear potentiometers

Accelerometers, Gyroscopes:

- 1 axis, 2 axis, 3 axis

EG: MPU9150: 3 axis gyroscope,
3 axis accelerometer+ 3 axis magnetic field
I^2C interface for ~$10.

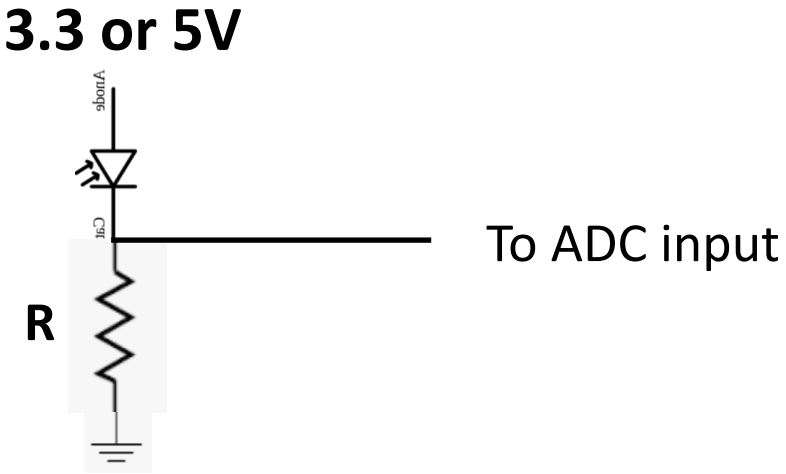
EG: LIS3L02AQ – 3 axis accelerometer with analog outputs.



Pressure Sensors

- Gas or liquid (MPX5100)
- Mechanical (IESF-R-5L)

Connecting resistive or current sensors



R the same order of magnitude
As the resistance range of the sensor

Heart Beat Monitor and Blood Oxygenation Sensor **MAX30102**

The module is in your kit. You will work with it in the lab (part 9 in the manual).

It eart Beat monitor a ation sensor.

Addresable light strips

https://www.adafruit.com/product/2842?length=1

Controlling things with the microcontroller

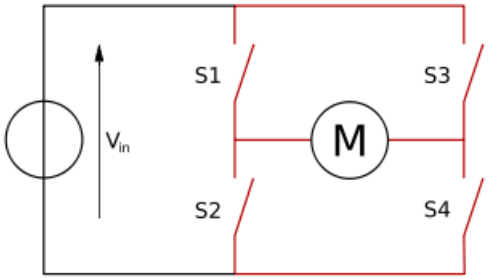
MSP430 P1.x maximum output current: +/- 6 mA (x 3.3V = 20mW)
To drive external loads that are more demanding than logic chips, the MSP430 needs some help.
Some possibilities:

- op-amps
- Buffer/driver
- Transistor (bipolar or MOSFET)
- opto-isolators
- Relay
- Solid-state relay
- H Bridge chip (eg for bi-directional motors)

REFERENCE: The Art of Electronics (Horowitz and Hill)

Driving Motors: H-bridge

To drive a dc motor in either direction with a single power supply, close S1 and S4 OR S2 and S3.



http://en.wikipedia.org/wiki/File:H_bridge.svg

The switches are often transistors: bipolar or MOSFETs

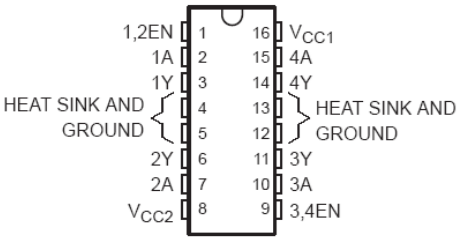
Driving Motors: H-bridge

SN754410
QUADRUPLE HALF-H DRIVER

SLRS007B – NOVEMBER 1986 – REVISED NOVEMBER 1995

- **1-A Output-Current Capability Per Driver**
- **Applications Include Half-H and Full-H Solenoid Drivers and Motor Drivers**
- **Designed for Positive-Supply Applications**
- **Wide Supply-Voltage Range of 4.5 V to 36 V**
- **TTL- and CMOS-Compatible High-Impedance Diode-Clamped Inputs**
- **Separate Input-Logic Supply**
- **Thermal Shutdown**
- **Internal ESD Protection**
- **Input Hysteresis Improves Noise Immunity**
- **3-State Outputs**
- **Minimized Power Dissipation**
- **Sink/Source Interlock Circuitry Prevents Simultaneous Conduction**
- **No Output Glitch During Power Up or Power Down**
- **Improved Functional Replacement for the SGS L293**

NE PACKAGE
(TOP VIEW)



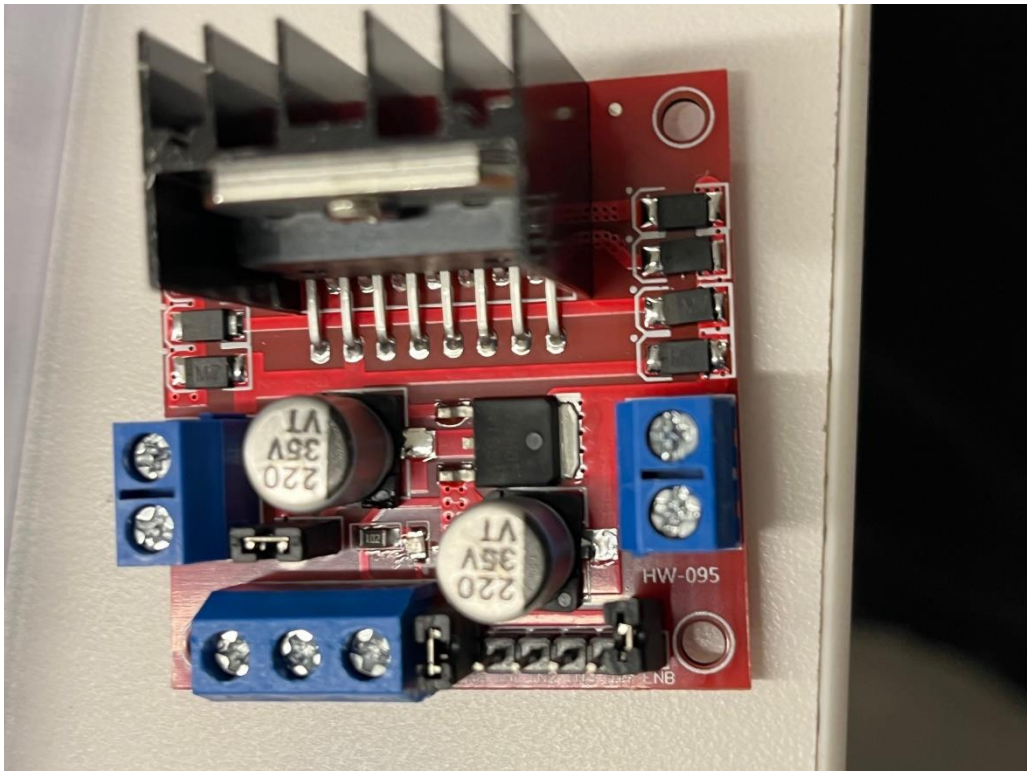
FUNCTION TABLE
(each driver)

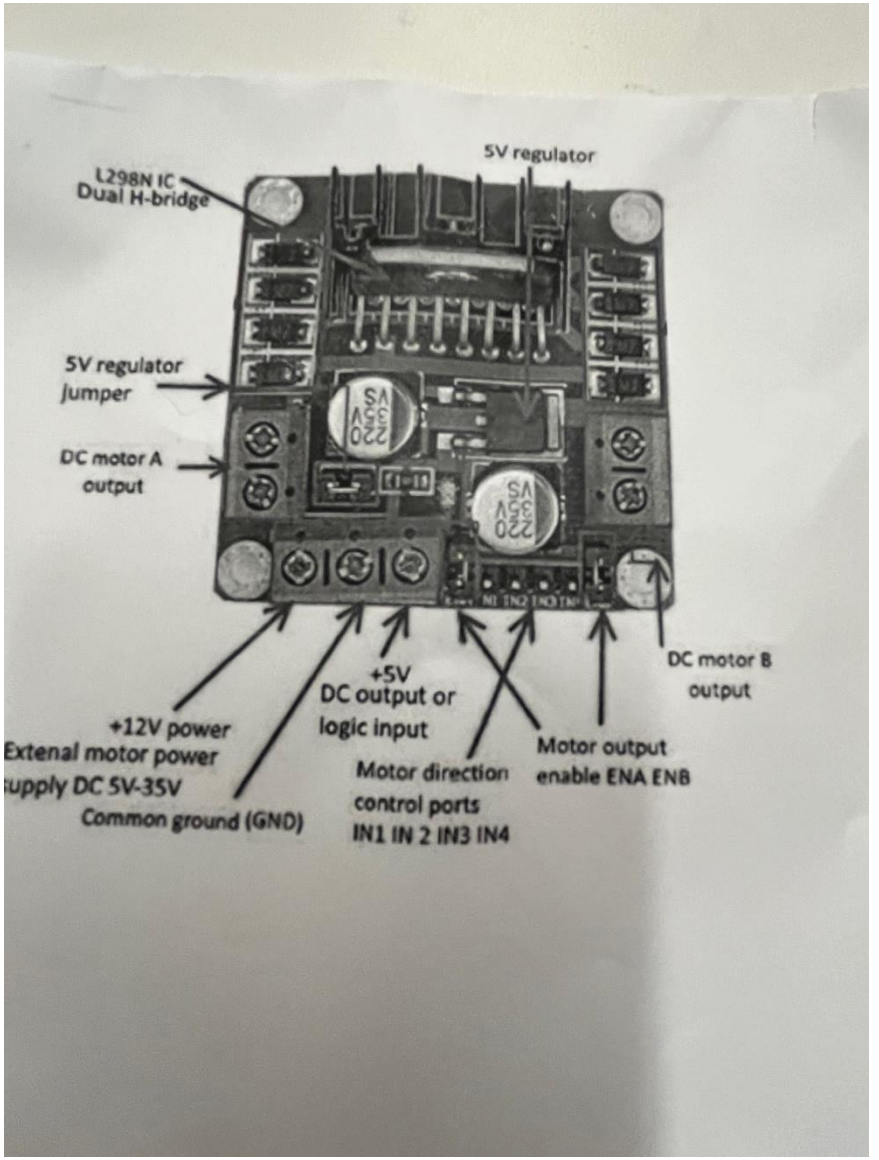
INPUTS†		OUTPUT
A	EN	Y
H	H	H
L	H	L
X	L	Z

H = high-level, L = low-level
X = irrelevant
Z = high-impedance (off)
† In the thermal shutdown mode, the output is in a high-impedance state regardless of the input levels.

description

The SN754410 is a quadruple high-current half-H driver designed to provide bidirectional drive currents up to 1 A at voltages from 4.5 V to 36 V. The device is designed to drive inductive loads such as relays, solenoids, dc and bipolar stepping motors, as well as other high-current/high-voltage loads in positive-supply applications.


HW-095


L298N IC
Dual H-bridge
5V regulator
5V regulator
jumper
DC motor A
output
DC motor B
output
+12V power
Extenal motor power
supply DC 5V-35V
Common ground (GND)
+5V
DC output or
logic input
Motor direction
control ports
IN1 IN 2 IN3 IN4
Motor output
enable ENA ENB

Powering your project

Easiest, if it works:

- Launchpad from your computer
- the board/external circuitry with the wall wart we've provided.
- any higher current devices (eg big motors) from the power banks, batteries or a power supply available in the lab.

Powering your project

For mobile platforms or other devices:

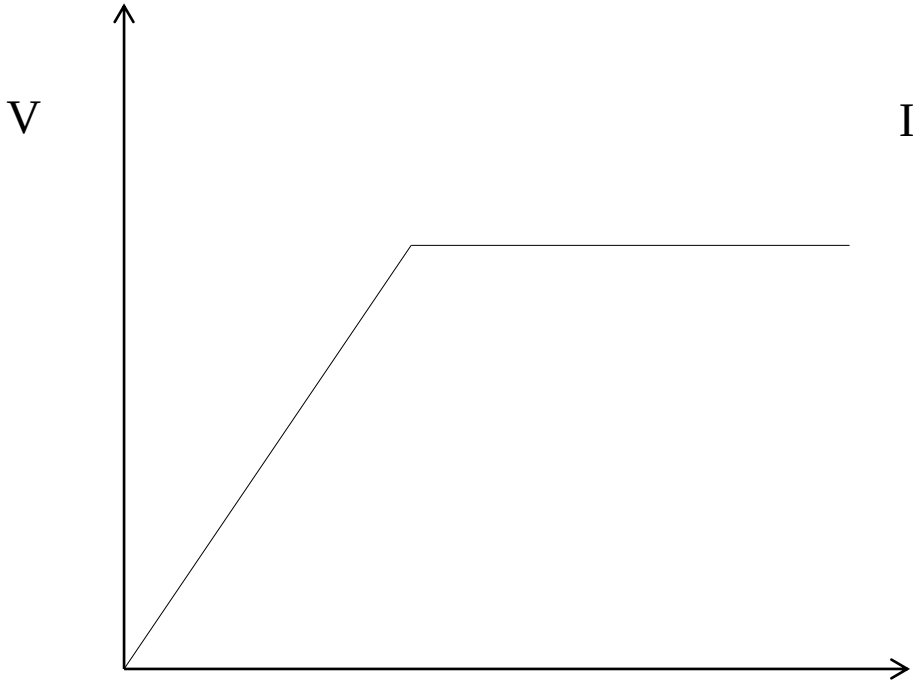
Launchpad and control electronics from power researchable bank.

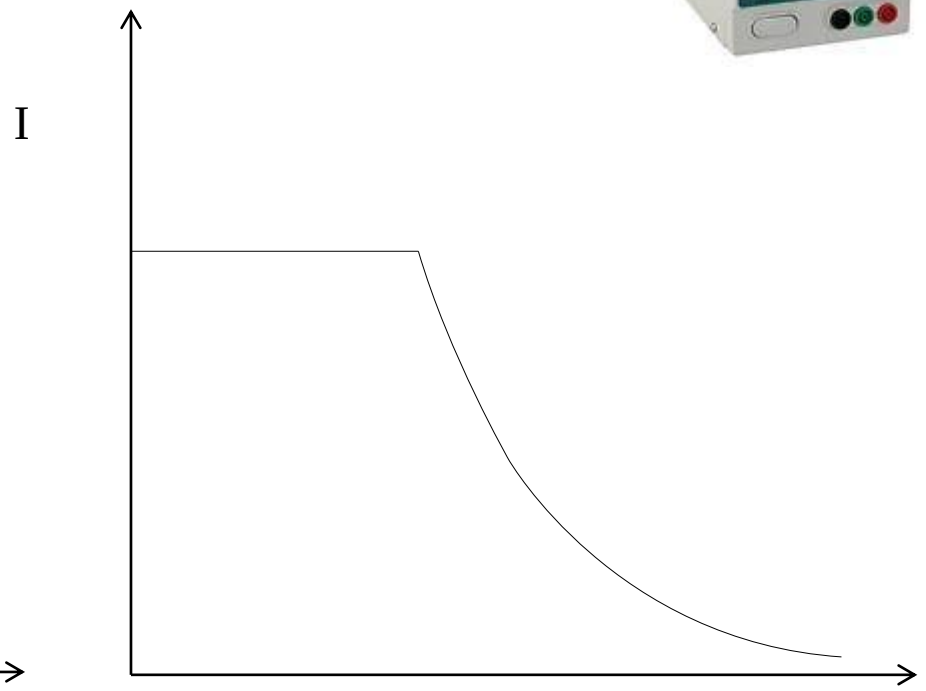
Very higher current devices (motors, electromagnets) from the batteries.

USB power supply

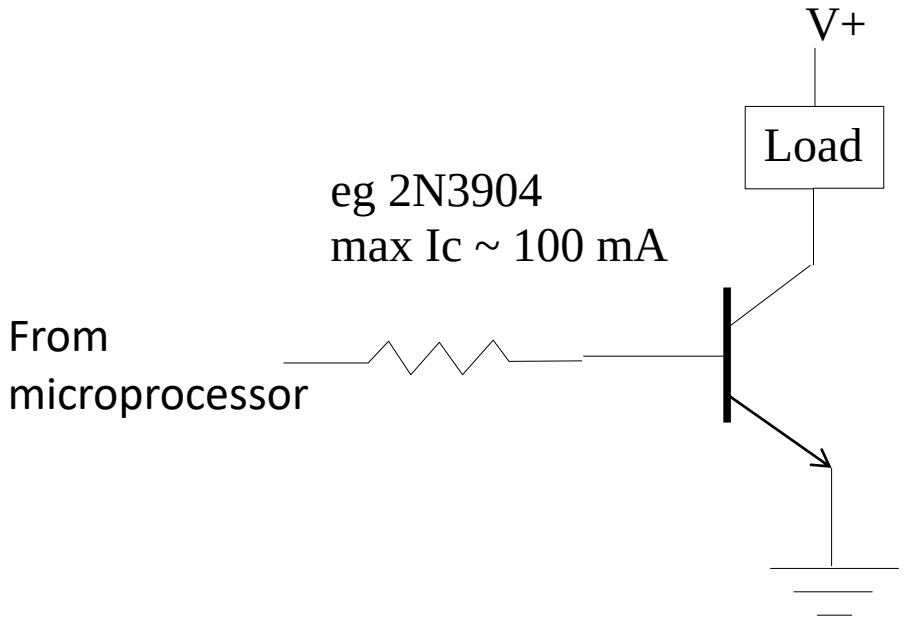
USB Plug Ins with USB connections are regulated at 5V

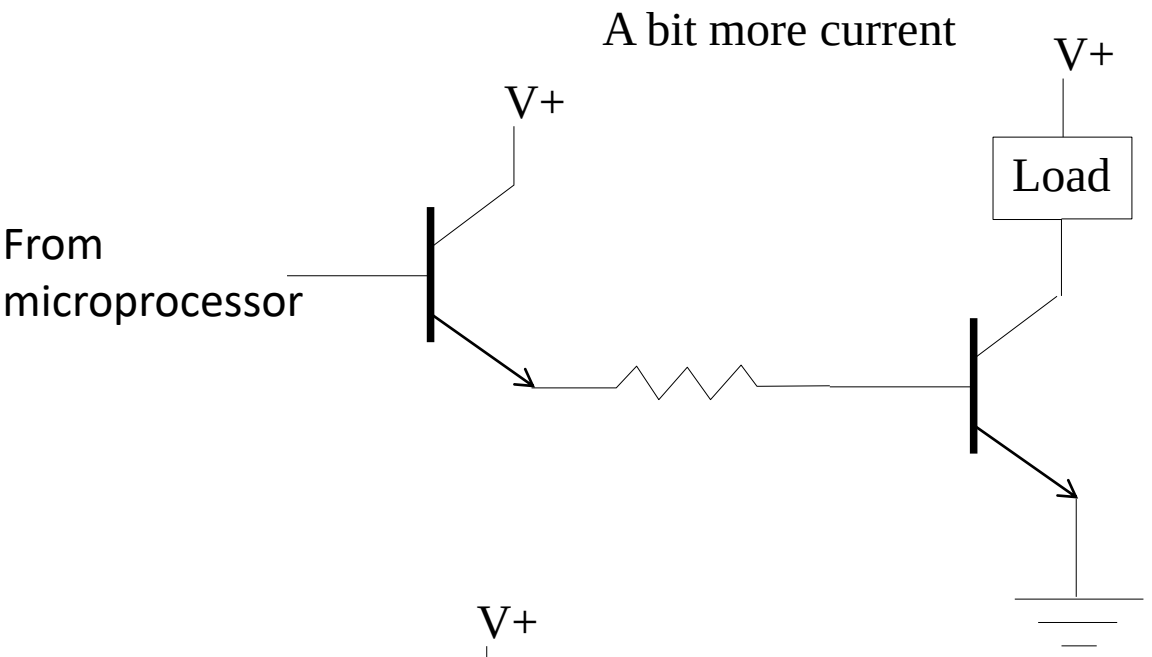
Bench/Lab supplies

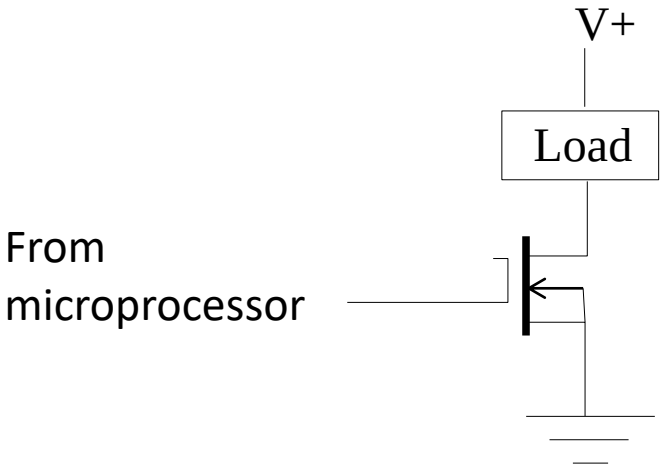




Driving loads: Transistors



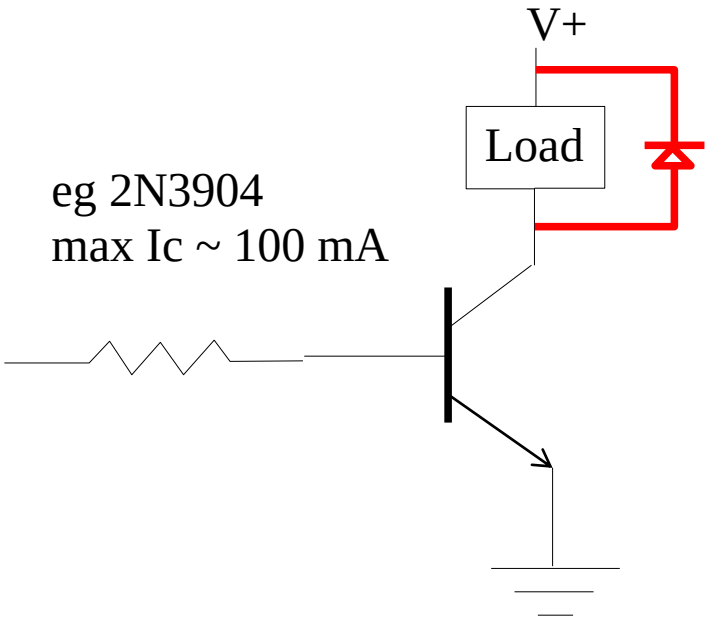


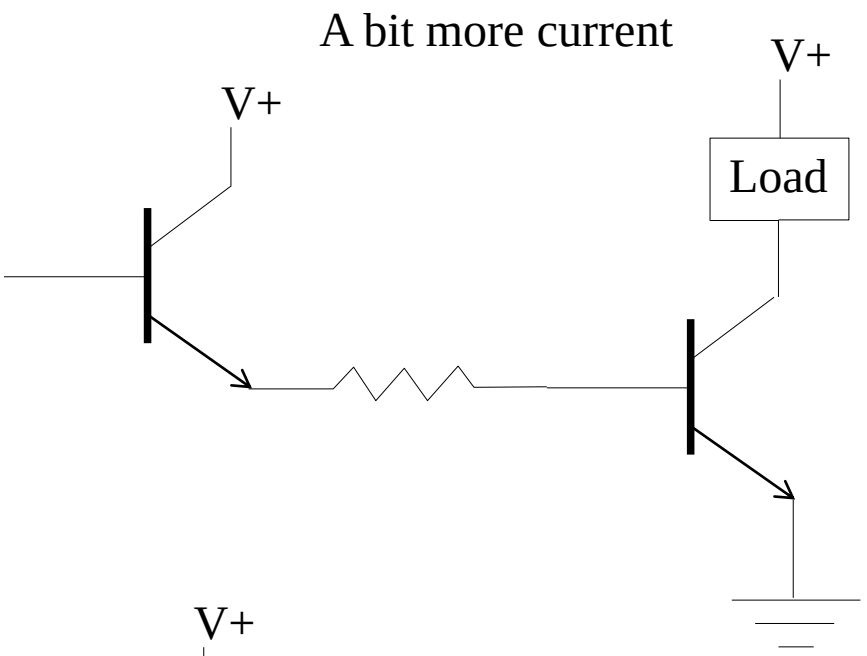


maximum current:
how much do you want?

N-channel mosfet

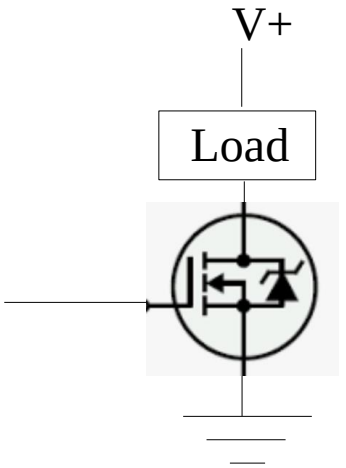
Driving loads: Transistors





Inductive loads require that
you protect the transistor with a diode!

Many FETs have a diode
build in



N-channel mosfet